

QUESTION #	1	2	3	4	TOTAL
MAX POINTS	16	14	14	16	45
POINTS EARNED	15	8.5	13.5	9	

University of Bahrain

College of Information Technology

Department of Computer Science

ITCS332: Concepts of Programming Languages FIRST TEST

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## QUESTION ONE:

[10+6 pts]

1) ?- [1, 2|X] = [1, 2, 3, 4, 5].

a) error

b) X = [3, 4]

✓ (c) X = [3, 4, 5]

d) none

2) ?- Y is X+2, X=1.

a) Y = 1+2  
X = 1b) Y = 3  
X = 1

✓ (c) error message

d) Y = X+2  
X = 1

3) For the query: "[T|H] = [[mouse, dog], rabbit, cat, lion].", Prolog produces:

T = [mouse, dog] ✓

H = [rabbit, cat, lion] ✓

4) For the query: "L=[t|L4], L3=[u,v,r], L4=[3,4,5 | L3].", Prolog produces:

L4 = [3, 4, 5, u, v, r] ✓

L = [t, 3, 4, 5, u, v, r] ✓

What55 (K,K, [K]).

What55 (I,K, [I|L]) :- I &lt; K, I1 is I + 1, What55 (I1,K,L).

5) For the query ?- What55 (5,9,U). Prolog produces

U = [5, 6, 7, 8, 9] ✓

What88 ([], []).

What88 ([A], [A,A]).

What88 ([A,B|C], [B,A|D]) :- What88 (C,D).

6) For the query ?- What88 ([5,a,9,f,4,u], L). Prolog produces

L = [a, 5, f, 9, u, 4] ✓

7) Write Prolog rules (predicates) named minus5 that takes a list of any numbers and produces a new list each element of which is equal to the corresponding element of the original list minus 5.

minus5 ([], []). ✓

minus5 ([H|T], [N|L]) :- H is H-5, minus5 (T, N|L).

minus5 ([], []).

minus5 ([H|T], [H5,TB]) :-



# QUESTION TWO:

$\langle id \rangle (+|-)$

[14 pts]

- Carefully study the following grammar and answer the 3 questions.

$\langle update \rangle \rightarrow \langle id \rangle ++ \mid \langle id \rangle -- \mid -- \langle id \rangle \mid ++ \langle id \rangle \mid \langle id \rangle = \langle id \rangle + \langle digit \rangle \mid \langle id \rangle = \langle id \rangle - \langle digit \rangle \mid \langle id \rangle += \langle digit \rangle \mid \langle id \rangle -= \langle digit \rangle$   
 $\langle statements \rangle \rightarrow \langle statement \rangle ; \mid \{ \langle statement \rangle ; \} \mid \{ \langle compound \rangle \} \langle digit \rangle$   
 $\langle compound \rangle \rightarrow \langle statement \rangle ; \langle compound \rangle$

- List ALL terminal symbols:

$++, --, +, -, =, +=, -=, \{, \}, ;$

- List ALL nonterminal symbols:

$\langle update \rangle, \langle id \rangle, \langle digit \rangle, \langle statements \rangle, \langle statement \rangle, \langle compound \rangle$

- Convert the above-given BNF-grammar rules into EBNF.

$\langle update \rangle \rightarrow (\langle id \rangle ++ \mid \langle id \rangle -- \mid -- \langle id \rangle \mid ++ \langle id \rangle \mid \langle id \rangle = \langle id \rangle + \langle digit \rangle \mid \langle id \rangle = \langle id \rangle - \langle digit \rangle \mid \langle id \rangle += \langle digit \rangle \mid \langle id \rangle -= \langle digit \rangle)$   
 $\langle statements \rangle \rightarrow \langle statement \rangle ; \mid \{ \langle statement \rangle ; \} \mid \{ \langle compound \rangle \} \langle digit \rangle$   
 $\langle compound \rangle \rightarrow \langle statement \rangle ; \langle compound \rangle$

$\langle update \rangle \rightarrow (\langle id \rangle ++ \mid \langle id \rangle -- \mid -- \langle id \rangle \mid ++ \langle id \rangle \mid \langle id \rangle = \langle id \rangle (+|-) \langle digit \rangle)$   
 $\langle id \rangle = \langle id \rangle (+|-) \langle digit \rangle$

- Convert the following EBNF-grammar rules into BNF

$\langle expr \rangle \rightarrow \langle expr \rangle \{ \langle \langle expr \rangle \rangle \}$   
 $\langle strings \rangle \rightarrow " \langle chars \rangle " \{ \langle \langle " \langle chars \rangle " \rangle \}$   
 $\langle chars \rangle \rightarrow \{ \langle char \rangle \}$   
 $\langle char \rangle \rightarrow \langle letter \rangle \mid \langle digit \rangle \mid \langle sign \rangle$   
 $\langle ids \rangle \rightarrow \langle id \rangle \{ \rangle \langle id \rangle \}$

$\langle expr \rangle \rightarrow \langle expr \rangle \mid \langle expr \rangle \langle \langle expr \rangle \rangle$   
 $\langle strings \rangle \rightarrow " \langle chars \rangle " \mid " \langle chars \rangle " \langle \langle " \langle chars \rangle " \rangle$   
 $\langle chars \rangle \rightarrow \langle char \rangle \langle chars \rangle \mid \langle char \rangle$   
 $\langle char \rangle \rightarrow \langle letter \rangle \mid \langle digit \rangle \mid \langle sign \rangle$   
 $\langle ids \rangle \rightarrow \langle id \rangle \mid \langle id \rangle \rangle \langle id \rangle$



QUESTION THREE: Fill in blanks Questions gab [114 pts]

- 1) The main bottleneck in von Neumann computers is Memory CPU speed job.  
The bottleneck in interpreting systems is statement decoding.
- 2) Computer applications are classified in 5 categories, name any 2 of them:  
Business application and Scientific application software program web
- 3) The value of inherited attribute depends on the attribute values of that node's parent node and those of its sibling nodes; the value of synthesized attribute depends only on the values of the attributes on that node's children nodes.
- 4) BNF cannot describe all aspects of the syntax of programming languages. From any language you know, give 2 aspects (cases, situations) that cannot be described (or very hard to describe) in BNF:  
Type checking ID
- 5) floating variable can not assign to int or all variable must be declarative before they reference  
The order of evaluating expressions with operators of different levels is defined by Precedence rule; the order of evaluating expressions with operators of the same level is defined by Associativity rule.
- 6) The number of lexemes in a "while(aa <= (bb-2\*999))" is 12; the number of different tokens in the same sentence is 8.
- 7) In axiomatic semantics, each statement is preceded by a precondition and followed by a postcondition; in denotational semantics, the meaning of each language construct is denoted by a mathematical object.
- 8) The process of finding useful values for variables in propositions that allows matching process to succeed is called unification. The process of assigning temporary values to variables to allow unification to succeed is called instantiation.
- 9) There are 2 approaches of matching a given goal to facts in a database:  
Forward chaining and backward chaining.
- 10) The process of finding a complete sequence of propositions (proof) for the first subgoal before working on others is called depth first; the process that works on all subgoals of a given goal in parallel is called breadth first.
- 11) Statements in Prolog programs are 3 kinds, name any two of them:  
fact / query and rule.
- 12) Language design is influenced by 2 factors: Computer Architecture and programming Paradigm.
- 13) Attribute grammar is a context-free grammar (BNF) plus 3 additions, name any two of them:  
Attribute value and semantic function.
- 14) The right side of the Prolog headed Horn clause statement is called Antecedent.  
the left side of the Prolog headed Horn clause statement is called Consequent.

{ axiomatic semantics, forward chaining, synthesized, semantic functions, depth-first, query, type checking, lexeme, lexeme, Associativity, denotational semantics, backward chaining, depth-first, sentence, derivation, sentential form, forward-chaining, syntax, inherited, predicate functions, breadth-first, breadth-first, unification, instantiation, operational semantics, interpreting languages, statement decoding, precedence, compiling languages, static semantics, Exception handling, forward-chaining }.



**QUESTION FOUR:** Circle the best CORRECT answer for each of the following questions [16 pts]

- 1) The applications that heavily use tables of decimal numbers belong to \_\_\_\_\_ category.  
 a) Scientific    ☒ b) Business    c) Web    d) AI    d) System
- 2) With an ambiguous grammar, the number of parse trees for a given string that is not in the language is  
☒ a) Zero    b) Exactly one    ☒ c) One or more    d) Zero or more
- 3) Demanding all type checking to be performed improves \_\_\_\_\_  
☒ a) readability    ☒ b) reliability    c) writeability    d) ALL
- 4) The process of constructing a parse trees from a set of tokens is called:  
 a) Parsing    ☒ b) Lexical analysis    ☒ c) Semantics analysis    d) Optimization
- 5) A program that processes the application program immediately before it is being compiled is called  
 a) Microprocessor    ☒ b) Preprocessor    c) Macroprocessor    d) Pentium processor
- 6) Which of the following does not improve language reliability?  
 a) Index checking    b) Type checking    c) Exception handling    ☒ d) Pointers
- 7) Type checking may be performed during program:  
 a) Compilation    b) Linking    c) Execution    d) Loading    ☒ e) a or c
- 8) The set of techniques used by compilers to improve the program efficiency is called:  
 a) Parsing    b) Lexical analysis    c) Semantics analysis    ☒ d) Optimization
- 9) A category of languages that requires the programmer to specify what is to be done only is (i.e. there is no need to specify how to do things in detail).  
☒ a) Declarative    b) Functional    ☒ c) Procedural    d) Imperative
- 10) Languages based on data abstraction, inheritance, and polymorphism belong to \_\_\_\_\_ category.  
☒ a) Object-oriented    b) Functional    c) Logic    d) Markup    e) None
- 11) An example of conflicts between execution speed and reliability is:  
 a) Aliases    b) Function call checking    ☒ c) Operator multiplicity  
☒ d) Index range checking    ☒ e) None
- 12) The order of operator evaluation in the expression:  $5+6-4$  is defined by \_\_\_\_\_ rules:  
 a) Precedence    ☒ b) Associativity    c) Orthogonality    d) Overloading
- 13) The language with fewer exceptions is more \_\_\_\_\_ than one with more exceptions.  
 a) Expressive    b) Writeable    ☒ c) Orthogonal    d) None
- 14) A language feature that allows a single symbol to have multiple meanings" is called:  
 a) Expressivity    ☒ b) Multiplicity    c) Orthogonality    ☒ d) Overloading    e) None
- 15) A language feature: "Having more than one way of doing the same thing" is called:  
 a) Expressivity    ☒ b) Overloading    c) Orthogonality    ☒ d) Multiplicity
- 16) The type of semantics in which each statement in a program is preceded and followed by "predicates", is called:  
☒ a) Axiomatic    b) Denotational    c) Static semantics    d) Operational

Question #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Answer	b	<del>c</del>	<del>a</del>	<del>b</del>	b	d	e	<del>c</del>	<del>b</del>	a	<del>c</del>	b	c	<del>d</del>	<del>b</del>	a